

## CLAIMS

What is claimed is:

1        1. A data converter for converting a group of vectors from a time serial to a time parallel  
2 format, wherein in the time serial format, sets of corresponding components of the vectors each  
3 have a time slot, and in time parallel format, each vector has a time slot, the converter comprising:

4                an input rotator configured to rotate each set of corresponding components of all  
5 vectors by an amount that depends on the time slot of the set of corresponding components;

6                a bank of register files coupled to the input rotator to receive the rotated set of  
7 corresponding components, and having a register file in the bank configured to store each rotated  
8 set of corresponding components;

9                an output rotator coupled to the bank of registers files, for receiving and rotating the  
10 components of a vector an amount that depends on the time slot of the vector; and

11                a controller configured to control the addressing of the bank of register files when  
12 the corresponding components of each vector are stored in a register of the bank, and to control the  
13 addressing of the bank to collect the components of each vector for subsequent output rotation.

1        2. The data converter of claim 1,

2                wherein each vector has  $n$  components indexed from 0 to  $n - 1$  such that there are 0 to  
3  $n - 1$  sets of corresponding components; and

4                wherein the amount of rotation by the input rotator is zero for the 0<sup>th</sup> set of  
5 corresponding components, and  $n - 1$  steps clockwise for the  $(n - 1)$ th set, any intervening sets of  
6 corresponding components being rotated by an amount equal to the ordinal number of the set.

1        3. The data converter of claim 1,

2                wherein there are  $n$  vectors indexed from 0 to  $n - 1$ ; and

3                wherein the amount of rotation by the output rotator is zero for the 0<sup>th</sup> vector and  $n - 1$   
4 steps counter-clockwise for the  $(n - 1)$ th vector, any intervening vectors being rotated by an amount  
5 equal to the ordinal number of the vector.

1        4. The data converter of claim 1, wherein each register file in the bank includes a register for

2 storing the vector components.

1        5. The data converter of claim 4, wherein each vector has  $n$  components and each register  
2 file in the bank has  $n$  component registers.

1        6. The data converter of claim 5, wherein there are  $n$  register files in the bank.

1        7. The data converter of claim 1, wherein the bank of register files is configured to write and  
2 read the vector components at the same clock cycle.

1        8. The data converter of claim 1, wherein the controller can alternate between horizontal  
2 writing and reading operations and vertical writing and reading operations on the bank of register  
3 files.

1        9. The data converter of claim 8, wherein the vector has  $n$  components and the controller  
2 horizontally writes  $n$  sets of corresponding components and horizontally reads  $n$  vectors.

1        10. The data converter of claim 9, wherein, after the controller horizontally writes  $n$  sets of  
2 corresponding components and horizontally reads  $n$  vectors, the controller vertically writes  $n$  sets of  
3 corresponding components and vertically reads  $n$  vectors.

1        11. The data converter of claim 1, wherein the output rotator rotates the vector component a  
2 position equal and opposite to the input rotator.

1        12. A method for converting a group of vectors from a time serial to a time parallel format,  
2 wherein in the time serial format, sets of corresponding components of the vectors each have a time  
3 slot, and in time parallel format, each vector has a time slot, the method comprising:

4              for each set of corresponding components, rotating the corresponding components an  
5 amount that depends on the time slot of the corresponding component and writing each set of  
6 rotated corresponding components in a separate set of registers in a bank of register files; and

7              for each vector in the group, reading selected registers in the bank to collect the  
8 components of the vector and rotating the collected components of the vector an amount that  
9 depends on the time slot of the vector.

1        13. The method of claim 12, wherein if the vector components are written horizontally to the  
2 bank of register files, then the vector components are read horizontally from the bank of register  
3 files.

1        14. The method of claim 12, wherein if the vector components are written vertically to the  
2 bank of register files, then the vector components are read vertically from the bank of register files.

1        15. The method of claim 12, wherein a set of corresponding components is written and the  
2 components of a vector are read in the same clock cycle.

1        16. The method of claim 12,  
2            wherein the vector has  $n$  components; and  
3            wherein  $n$  sets of corresponding components are horizontally written over  $n$  clock  
4 cycles and vectors are horizontally read over the same  $n$  clock cycles.

1        17. The method of claim 16, wherein in another  $n$  clock cycles subsequent to the  $n$  clock  
2 cycles,  $n$  sets of corresponding components are vertically written over  $n$  clock cycles and vectors  
3 are vertically read over the same  $n$  clock cycles.

1        18. An data converter for converting a group of vectors from a time serial to a time parallel  
2 format, wherein in the time serial format, sets of corresponding components of the vectors each  
3 have a time slot, and in time parallel format, each vector has a time slot, the converter comprising:

4            input rotation means for rotating each set of corresponding components of all vectors  
5 by a first prescribed amount depending on the particular set;

6            storage means coupled to the input rotation means, for storing the rotated set of  
7 corresponding components; and

8            output rotation means coupled to the storage means, for receiving components of a  
9 vector from the storage means and rotating the components of the vector by a second prescribed  
10 amount depending on the particular vector.

1        19. The data converter of claim 18, wherein:

2                   the input rotation means is an input rotator configured to rotate each set of  
3 corresponding components of all vectors by an amount that depends on the time slot of the set of  
4 corresponding components;

5                   the storage means is a bank of register files with a register file in the bank  
6 configured to store each rotated set of corresponding components; and

7                   the output rotation means is an output rotator configured to receive and rotate  
8 the components of a vector an amount that depends on the time slot of the vector.

1                 20. The data converter of claim 19, wherein the storage means is configured to write and  
2 read the vector components in the same clock cycle.

1                 21. The data converter of claim 20, wherein the storage means is configured to write  
2 corresponding components horizontally and then read vectors horizontally over a prescribed number  
3 of clock cycles.

1                 22. The data converter of claim 21, wherein, during another prescribed number of clock  
2 cycles, the storage means is configured to write corresponding components vertically and then read  
3 vectors vertically.

1                 23. The data converter of claim 18 further comprising controller means communicably  
2 coupled to the input rotator means, the storage means and the output rotator means, for controlling  
3 the operations thereof.

1                 24. The data converter of claim 23, wherein the controller means is operable to control the  
2 writing and reading of the vector components to the storage means and operable to control the  
3 rotation of the vector components by the output rotation means and the input rotation means.

1                 25. The data converter of claim 18, wherein the output rotation means rotates time parallel  
2 vector components in a direction opposite to the direction that the input rotation means rotates a set  
3 of corresponding vector components.

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